Chemical, nutritional and technological characteristics of buckwheat and non-prolamine buckwheat flours in comparison of wheat flour

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Abstract. Chemical, nutritional, and technological characteristics of buckwheat and non-prolamine buckwheat flours in comparison to wheat for celiac patients use have been studied. The results suggested the following conclusions: the 56.5% extraction value for flour obtention is considered good; the buckwheat flour presents methionine and cystine as first limiting amino acids followed by threonine as the second limiting amino acid; the buckwheat flour presents higher content of lysine amino acids than the wheat flour; the buckwheat flour is superior to the wheat flour regarding iron, copper, and magnesium minerals; the buckwheat flour does not present haemagglutinin activity and the tannin content is negligible. Rheological assays indicate that the buckwheat flour does not contain gluten.

Introduction

Buckwheat (Fapopyrum esculentum Moench) is an herbaceous plant of the Polygonaceae family. It does not have any affinity for the Gramineae family, although insuitably named 'wheat', with which it presents no analogy, both because of its color and grain conformation (triangular nut shaped) [1].

Brazil has constantly exported buckwheat and it is the most demanded product by several European countries and also Japan, where a wide market of consumers is found to exist [2].

The chemical composition of whole and dehulled grain was determined by Kirilenko and Sarkisova [3]. They observed that dehulled grains presented high starch, protein, and thiamin contents and a low cellulose content. The essential amino acids were found to comprehend 38.75% of the total protein. Lysine, histidine, valine, and leucine were found in higher quantities, while methionine, tryptophan, and phenylalanine contents presented lower contents in whole grain proteins.

The buckwheat nutritional qualities have not yet been explored. It is known, however, that grains, for instance, may be used as rice substitutes or in soup, porridges, gravies, spices, and sauce preparation. As a flour, buckwheat may be
used in the manufacturing of bread, cookies, pies, pancakes, etc. It is more appreciated by some ethnic groups such as the Slavs, Arabs and Israelis [2]. Than by others, according to Taïra [4] buckwheat may be ground and its flour used to make macaroni, pancakes, and soup.

On the basis of the data presented and taking into account the buckwheat availability in Brazil, in addition to its nutritional value, the purpose of this research was to evaluate the chemical, nutritional, and technological properties of buckwheat flour, with or without the prolamine fraction.

Material and methods

Raw material. The raw material used in this work was buckwheat (*Fagopyrum esculentum*) with the seeds provided by the Cooperativa Triticota Mista Vacariense Ltda., from Vacaria, Rio Grande do Sul (Cooperval)

Flour obtainment. Buckwheat grain milling was performed in an experimental wheat mill Buhler-Miag, MLV-202 pneumatic model. This divided the flour into six fractions and in fine and coarse bran thus achieving a whiter buckwheat flour since small hull particles might come with the flour thus changing its color [5]. To obtain non-prolamine buckwheat flour, 70% ethanol was used as a solvent [6]. The buckwheat flour was submitted to two successive direct extractions with 70% ethanol in the ratio of 1:20; namely, for each gram of flour 20 ml of 70% ethanol was used. Each extraction was accomplished by stirring with a shovel type stirrer, 'LAVILL' brand, for one hour at room temperature. After each extraction, the mixture was allowed to rest for 30 min for decantation of the flour and the ethanol was extracted by siphonation. After the second extraction thin layers of flour were placed on trays and sent to forced air oven at 55 °C for approximately 12 hours for drying and ethanol evaporation. After drying it was ground again and a non-prolamine buckwheat flour was then attained (soluble protein fraction in 70% ethanol).

Chemical analyses. Buckwheat flour, non prolamine buckwheat flour, and wheat flour underwent chemical analyses in accordance with the methodology indicated by the AOAC [7] for crude protein (N x 6.25), ash, crude fiber, moisture, and ether extract. Carbohydrates were obtained by the difference. The profile of amino acids in buckwheat, non-prolamine buckwheat, and wheat flours was determined in an automatic analyzer (Beckman Aminoacid Analiser) using the techniques reported for this type of analysis, at the Centro de Proteinas in the Faculdade de Medicina de Ribeirão Preto, of the University of São Paulo. The tryptophan was determined by the alkaline hydrolysis by Hugli and Moore [8]; cystein by the cysteic acid procedure reported by Moore [9], and lysine by the method of Kakade and Liener [10]. Comparing the obtained values with the protein pattern of FAO [11], the amino acid score (AAS) was obtained as shown in the following